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(54) Injection moulding machines

(57) An injection moulding machine, Fig. 1, comprises a base 11 and at least two injection units 13B, 13A slidable on the base. Each unit has a barrel 19 with injection nozzle 20 for engaging a mould 14 to inject material therein. Driving means drive said units forwards on the base to bring the injection nozzle 20B of at least a first one 13B of said units 13 into engagement with a mould. Adjustment means 21 to 25, Fig. 3, are provided on at least a second one 13A of said units for adjusting the position of the second nozzle 20A relative to the first nozzle 20B so that both nozzles engage the mould 14 with sufficient strength to avoid leakage. The adjustment means may adjust the position of a nozzle relative to a barrel.

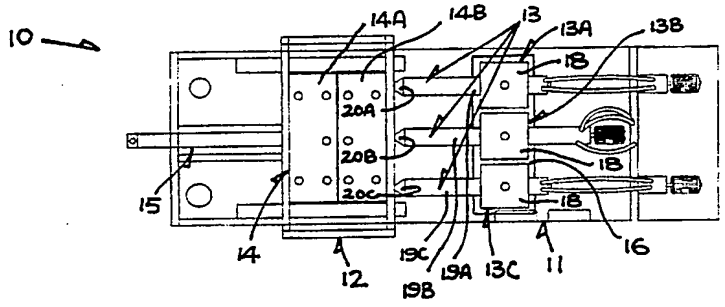

FIG. 1

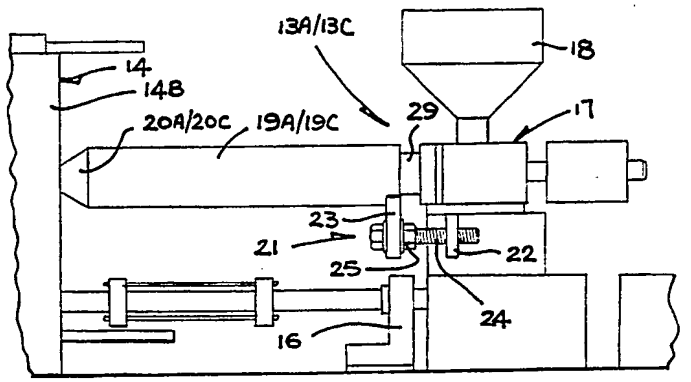

FIG. 3

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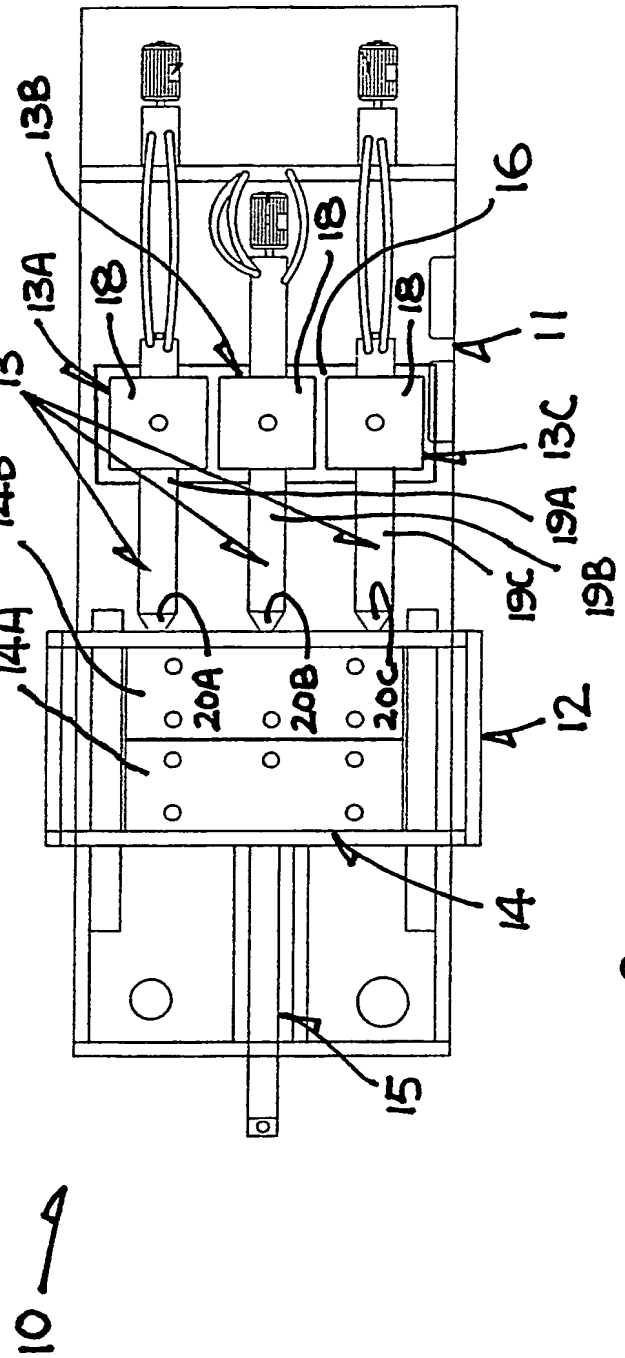
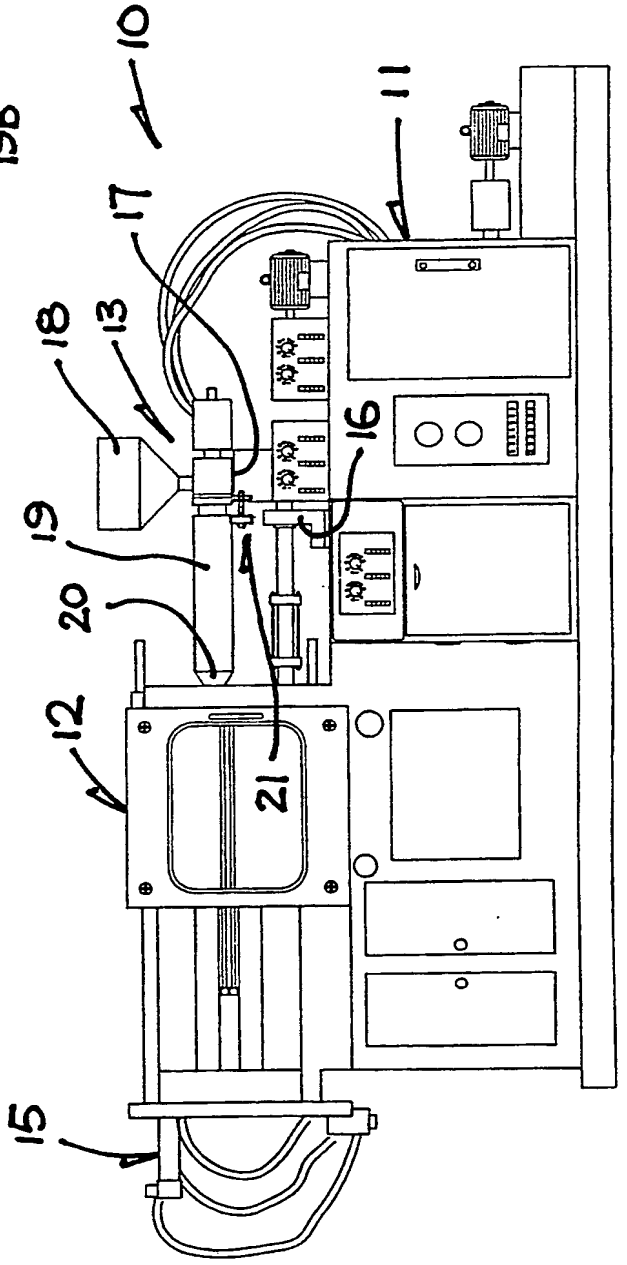

10
11
12
13
13A
13B
14
14A
14B
15
16
18
19A
19B
19C
20A
20B
20C

FIG. 1


10
11
12
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15
16
17
18
19
20
21

FIG. 2

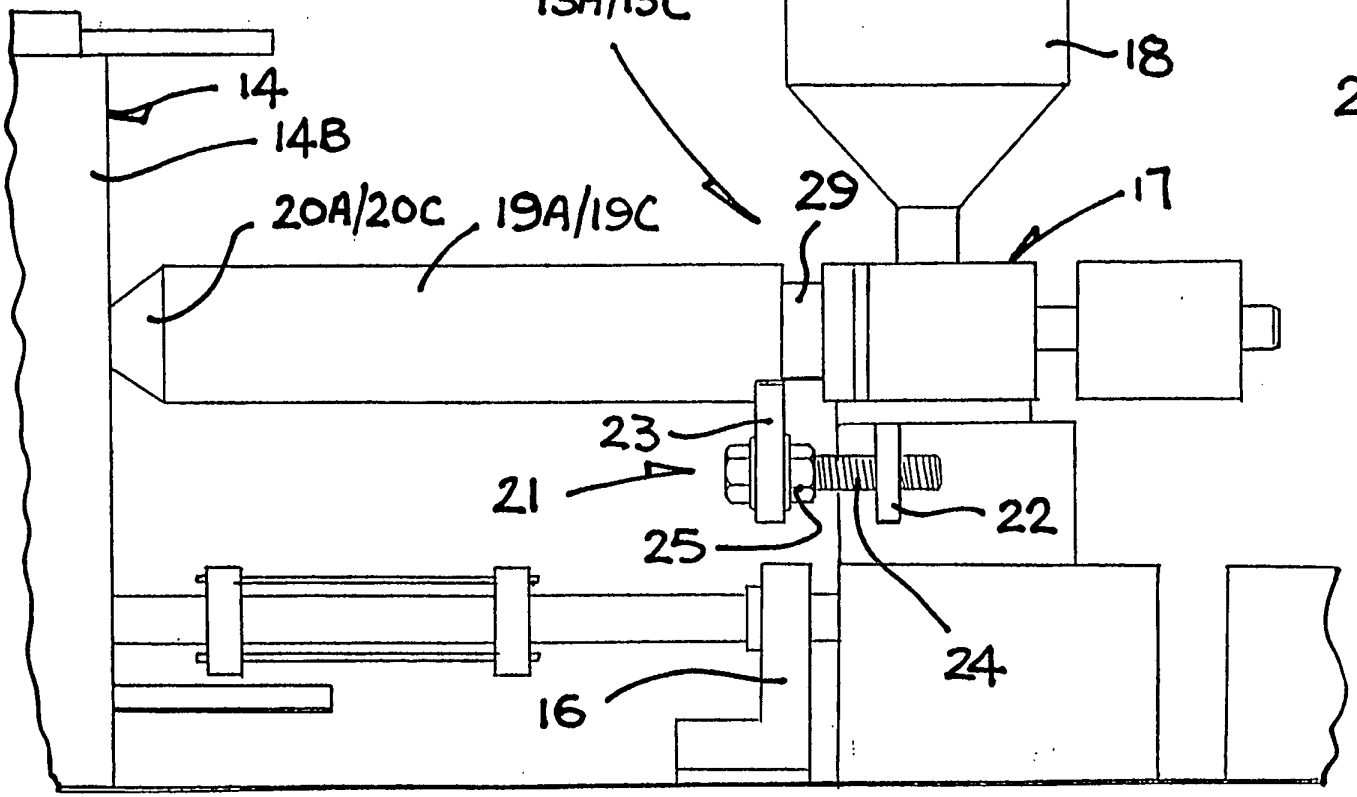
13A/13C
18
14
14B
20A/20C
19A/19C
29
17
23
21
22
25
24
16

FIG.3

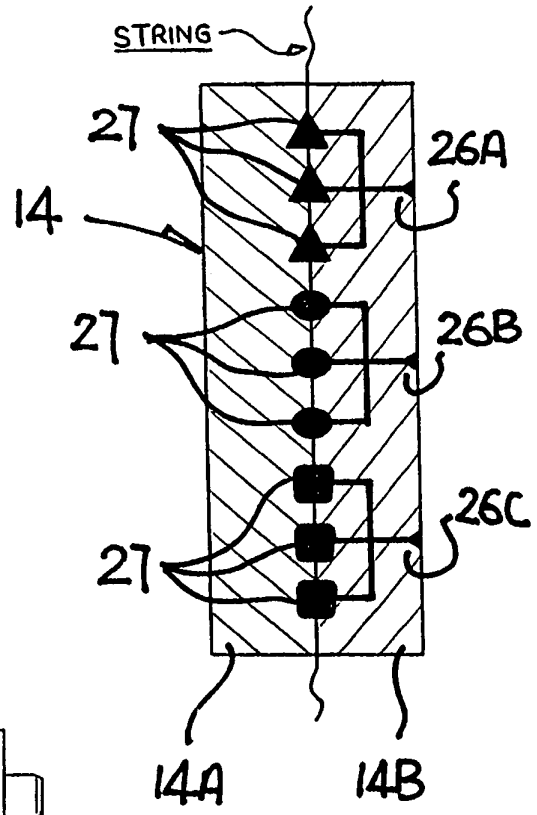
STRING
27
26A
14
27
26B
27
26C
14A
14B

FIG.4

INJECTION MOULDING MACHINE AND METHOD OF USING THE SAME

The present invention relates to an injection moulding machine and to a process of moulding multi-colour articles using such an injection moulding machine.

A first aspect of the invention provides an injection moulding machine comprising a base, at least two injection units slidably supported on the base, each of said injection units including an injection barrel having an injection nozzle for engaging against a mould in order to inject moulding material into a said mould, driving means for driving said at least two injection units forwards relative to the base in order to bring the injection nozzle of at least the first one of said injection units into engagement with a said mould, and adjustment means provided on the second one of said injection units for adjusting the position of the second injection nozzle relative to the first injection nozzle in order to ensure that both nozzles will engage against a said mould with sufficient strength to avoid any moulding material leakage.

It is preferred that the adjustment means is provided to adjust the effective length of the injection barrel of the second injection unit.

Preferably, the adjustment means is provided to adjust the position of the injection barrel of the second injection unit.

Preferably, the second injection unit has a body from which its injection barrel extends, and the adjustment means is provided between the injection barrel and the injection unit body.

In a preferred embodiment, the adjustment means comprises a screw-threaded member.

More preferably, fixed brackets are provided on the body and the injection barrel of the second injection unit, and the screw-threaded member engages with the brackets.

Advantageously, said at least two injection units are supported on a common carrier slidably supported on the base, and the driving means is arranged to drive the carrier forwards relative to the base.

The injection moulding machine may include three injection units. In this injection moulding machine, said adjustment means is provided on only two of the three injection units. Preferably, the two injection units provided with said adjustment means are located on opposite sides of the remaining injection unit.

A second aspect of the invention provides an injection moulding method using the injection moulding machine described above, which method comprises providing such an injection moulding machine, operating the driving means to

drive said at least two injection units forwards relative to the base in order to bring the injection nozzle of at least the first one of said injection units into engagement with a said mould, and operating the adjustment means to adjust the position of the second injection nozzle relative to the first injection nozzle in order to ensure that both nozzles will engage against a said mould with sufficient strength to avoid any moulding material leakage.

The injection moulding method may further include loosening the adjustment means before operating the driving means, and subsequently operating the driving means in order to ensure that the first nozzle will firstly engage against a said mould with sufficient strength to avoid any moulding material leakage.

Alternatively, the injection moulding method may further include operating the adjustment means before operating the driving means for withdrawing the second nozzle rearwards, and subsequently operating the driving means in order to ensure that the first nozzle will firstly engage against a said mould with sufficient strength to avoid any moulding material leakage.

The invention further provides a beaded string for a beaded curtain, which is manufactured by the described injection moulding method.

The invention will now be more particularly described, by way of example only, with reference to the accompanying drawings, in which;

Figure 1 is a plan view of an injection moulding machine in accordance with the invention;

Figure 2 is a side view of the injection moulding machine of Figure 1;

Figure 3 is a fragmentary enlarged side view of the injection moulding machine of Figure 1, showing an adjustment arrangement; and

Figure 4 is a cross-sectional plan view of a mould suitable for use in the injection moulding machine of Figure 1.

Referring to Figures 1 to 3 of the drawings, there is shown an injection moulding machine 10 embodying the invention, which comprises a elongate base 11, a mould assembly 12 provided on one end of the base 11 and three injection units 13 (13A, 13B and 13C) provided on opposite end of the base 11. The mould assembly 12 includes a two-part mould 14 and a pneumatic drive mechanism 15 for moving one mould part 14A towards or away from the other mould part 14B which is fixed on the base 11. The injection units 13 are supported on a common carrier 16 which is slidable and driven by a pneumatic drive mechanism (not shown) to slide

in either direction along the longitudinal extent of the base 11, thereby transporting the three injection units 13 simultaneously towards or away from the mould 14 and in particular the stationary mould part 14B.

Each injection unit 13 comprises a body 17 fixed on the carrier 16, an inverted funnel 18 provided atop the body 17, through which the body 17 can be replenished with moulding plastics beads, and a horizontal barrel 19 extending forwards from the upper part of the body 17. The barrel 19 has an injection nozzle 20 at its forward-most end and incorporates an internal co-axial metering screw (not shown) operable to deliver molten plastic from the body 17 through the barrel 19 forwards for injection through the nozzle 20 into the mould 14.

As best shown in Figure 1, the injection units 13 including their parts are differentiated by suffixes A, B and C following their reference numerals. The injection units 13 are arranged side-by-side with their barrels 19 extending in a parallel manner and longitudinally of the base 11. The injection unit 13B is positioned between the other two injection units 13A and 13C. Each of the side injection units 13A and 13C includes adjustment means 21 for adjusting the effective length of its barrel 19 measured from the corresponding body 17. The barrel 19 is slidably mounted on a co-axial hollow shaft 29 which is secured at its rear end to the body 17.

As best shown in Figure 3, the adjustment means 21 is provided by two brackets 22 and 23 and a screw-threaded bolt 24 engaging through the brackets 22 and 23. The bracket 22 is fixed on the outer side of the injection unit body 17, whereas the bracket 23 is fixed on the rear end of the barrel 19. The bolt 24 firstly passes through the bracket 23 and then engages through a nut 25 and with the bracket 22. The nut 25 is tightened to fixed the bolt 24 on the bracket 23, with the free end of the bolt 24 engaging the bracket 22, thereby determining the relative position of the barrel 19 on the shaft 29.

With this arrangement, the position of the barrel 19A or 19C and hence their nozzle 20A or 20C relative to the nozzle 20B of the middle injection unit 13B is adjustable. Insofar as the middle injection unit 13B is concerned, it does not incorporate such adjustment means 21, with the result that the relative position of the barrel 19B or its nozzle 20B cannot be adjusted.

Referring now to Figure 4 of the drawings, showing the internal construction of the mould 14 which is designed to manufacture beaded strings for a beaded curtain. Such a beaded curtain typically includes a series of depending strings, onto each of which strings discrete plastics beads are moulded at intervals along its length. These beads may be designed to have different shapes to enhance eye appeal. Further details of such beaded curtains are disclosed in UK

In this particular embodiment, the mould 14 is designed to have three independent sets of internal running paths for molten plastics. Each set has a conical entrance 26A, 26B or 26C and running paths leading to a group of three moulding cavities 27 of the same shape, though the cavity shape varies from one group to another. As the three sets of running paths are separate, the corresponding groups of moulding cavities 27 may be injected with different plastics materials and/or plastics materials of different colours, resulting in a multi-look/colour beaded string for enhancing eye appeal.

In initial operation, the carrier 16 of the injection moulding machine 10 is pneumatically driven forwards until the nozzle 20B of the middle injection unit 13B comes into sufficiently tight engagement with the middle entrance 26B of the mould 14. The position of the barrel 19A is then adjusted slightly forwards by means of the associated adjustment means 21 until the nozzle 20A engages with sufficient strength with the corresponding entrance 26A of the mould 14. Two spanners are necessary for operating the adjustment means 21, one for the head of the bolt 24 and the other for the nut 25. The nut 25 is firstly loosened slightly and is then turned simultaneously with the bolt head, thereby withdrawing the bolt 24 forwards from the bracket 22. In doing so, the bracket 23 and hence the

barrel 19A is pushed forwards by the nut 25 on the bolt 24, relative to the supporting shaft 29. When sufficient engagement strength is achieved between the nozzle 20A and the mould entrance 26A, the nut 25 is tightened against the bracket 23 in order to lock the barrel 19A in position. The same procedures are repeated for the barrel 19C and nozzle 20C of the remaining injection unit 13C.

The engagement strength between each nozzle 20 and the corresponding mould entrance 26 must be made sufficiently strong so as to avoid any undesirable leakage of moulding material through the engaged parts.

The moulding operations may now be commenced. The mould 14 is firstly closed by the drive mechanism 15 driving the mould part 14A against the stationary mould part 14B, with a string extending through the cavities 27 of the mould 14. Moulding materials of different colours are then injected into the cavities 27 of the mould 14 through the respective nozzles 20 and entrances 26 in order to form three groups of beads on the string, each group being of a specific colour. The mould 14 is subsequently opened by the drive mechanism 15 withdrawing the mould part 14A to permit removal of the then finished bead string. This completes one moulding operation, which may then be repeated to form another beaded string. At the end of the moulding op rations, the injection units 13 are withdrawn from the mould 14, either for replacing the mould 14 with another

mould for different bead designs or for switching off the injection moulding machine 10. Normally, it is not necessary to re-adjust the relative nozzle position or the effective barrel length of the injection units 13A and 13C before next use of the injection moulding machine 10.

It is appreciated repeated engagement and disengagement between the injection nozzles 20 and the mould 14 will inevitably cause damage or deformation to either one or both of the nozzles 20 and the mould 14 through normal wear and tear. When such damage or deformation occurs, the adjustment means 21 is useful for re-adjusting the relative nozzle position or the effective barrel length of the injection units 13A and 13C in order to align the three nozzles 20 with the corresponding mould entrances 26, thereby avoiding any moulding material leakage at the nozzle engagement.

Prior to the nozzle alignment, it is preferred to loosen the nuts 25 of both adjustment means 21 in order to ensure that the nozzle 20B of the middle injection unit 13B will firstly come into sufficiently tight engagement with the mould entrance 26B. Alternatively, the adjustment means 21 may be used to withdraw the injection barrels 19A and 19C rearwards in order to render the middle nozzle 20B most forward compared with the other two side nozzles 20A and 20C. Afterwards, leakage-proof nozzl -and-mould engagement for the side injection units 13A and 13C can be achieved

through the use of the adjustment means 21.

The adjustment means 21 is also useful for aligning injection nozzles 20 with a mould which does not have all the mould entrances lying on the same plane.

It is envisaged that the adjustment means according to the invention may be provided in a position other than the one described above, for example between the injection barrel and its nozzle. Also, the injection moulding machine may have two, four or more injection units.

The invention has been given by way of example only, and various other modifications of and/or alterations to the described embodiment may be made by persons skilled in the art without departing from the scope of the invention as specified in the appended claims.

CLAIMS

1. An injection moulding machine comprising a base, at least two injection units slidably supported on the base, each of said injection units including an injection barrel having an injection nozzle for engaging against a mould in order to inject moulding material into a said mould, driving means for driving said at least two injection units forwards relative to the base in order to bring the injection nozzle of at least the first one of said injection units into engagement with a said mould, and adjustment means provided on the second one of said injection units for adjusting the position of the second injection nozzle relative to the first injection nozzle in order to ensure that both nozzles will engage against a said mould with sufficient strength to avoid any moulding material leakage.

2. An injection moulding machine as claimed in claim 1, wherein the adjustment means is provided to adjust the effective length of the injection barrel of the second injection unit.

3. An injection moulding machine as claimed in claim 1 or claim 2, wherein the adjustment means is provided to adjust the position of the injection barrel of the second injection unit.

4. An injection moulding machine as claimed in any one of claims 1 to 3, wherein the second injection unit has a body from which its injection barrel extends, and the adjustment means is provided between the injection barrel and the injection unit body.

5. An injection moulding machine as claimed in any one of the preceding claims, wherein the adjustment means comprises a screw-threaded member.

6. An injection moulding machine as claimed in claim 5 when dependent upon claim 4, wherein fixed brackets are provided on the body and the injection barrel of the second injection unit, and the screw-threaded member engages with the brackets.

7. An injection moulding machine as claimed in any one of the preceding claims, wherein said at least two injection units are supported on a common carrier slidably supported on the base, and the driving means is arranged to drive the carrier forwards relative to the base.

8. An injection moulding machine as claimed in any one of the preceding claims, including three injection units.

9. An injection moulding machine as claimed in claim 8, wherein said adjustment means is provided on only two of the three injection units.

10. An injection moulding machine as claimed in claim 9, wherein the two injection units provided with said adjustment means are located on opposite sides of the remaining injection unit.

11. An injection moulding machine substantially as hereinbefore described with reference to Figures 1 to 4 of the accompanying drawings.

12. An injection moulding method using an injection moulding machine as claimed in any one of the preceding claims, which method comprises providing such an injection moulding machine, operating the driving means to drive said at least two injection units forwards relative to the base in order to bring the injection nozzle of at least the first one of said injection units into engagement with a said mould, and operating the adjustment means to adjust the position of the second injection nozzle relative to the first injection nozzle in order to ensure that both nozzles will engage against a said mould with sufficient strength to avoid any moulding material leakage.

13. An injection moulding method as claimed in claim 12, further including loosening the adjustment means before operating the driving means, and subsequently operating the driving means in order to ensure that the first nozzle will firstly engage against a said mould with sufficient strength to avoid any moulding material leakage.

14. An injection moulding method as claimed in claim 12, further including operating the adjustment means before operating the driving means for withdrawing the second nozzle rearwards, and subsequently operating the driving means in order to ensure that the first nozzle will firstly engage against a said mould with sufficient strength to avoid any moulding material leakage.

15. An injection moulding method using an injection moulding machine as claimed in any one of the preceding claims, substantially as hereinbefore described with reference to Figures 1 to 4 of the accompanying drawings.

16. A beaded string for a beaded curtain, which is manufactured by an injection moulding method as claimed in any one of claims 12 to 15.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

-15-

Application number
GB 9306519.1

Relevant Technical Fields

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(ii) Int Cl (Ed.5) B29C

Search Examiner
MR WERRETT

Date of completion of Search
17.06.94

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant following a search in respect of Claims :-
1 TO 16

Categories of documents

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P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

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